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JACK D. JOHNSON  
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ARID/SEMI-ARID NATURAL RESOURCES PROGRAM

NEWSLETTER



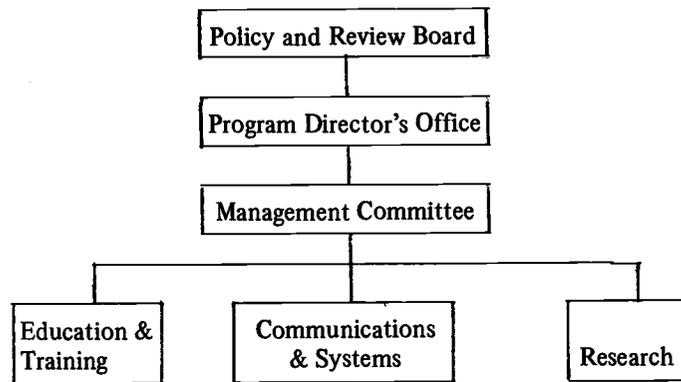
No. 1  
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UNIVERSITY OF ARIZONA  
Tucson, Arizona 85721, USA

Southwest Asia . . . Wind Power . . . Remote Sensing . . . On-Line . . . Watersheds . . . Policy . . . Growth . . .

Geothermal . . . ALIS/CIS . . . Water . . . Environment . . . Africa . . . Research

**NATURAL RESOURCES PROGRAM  
Organizational Chart**



**Supported by U.S. Agency for International Development**

## ARID/SEMI-ARID NATURAL RESOURCES PROGRAM

University of Arizona, Tucson

In the spring of 1974, the University of Arizona received a five-year grant from the U.S. Agency for International Development (AID), for the purpose of increasing the University's competence and institutional response capability in the planning and management of natural resources in arid/semi-arid developing countries. As a result of the grant, the University established the Arid/Semi-Arid Natural Resources Program (NRP), with special emphasis on the socioeconomic, institutional, legal, and public policy aspects of resource management.

Although the University of Arizona's applied research for over eighty years has been largely arid lands oriented, to serve the people of a state more than ninety percent arid or semi-arid, the worldwide counterparts of Arizona's arid environment have sponsored a natural affinity with the international arid lands community. Students from arid lands outside the United States constitute over fifty percent of the total University foreign student body, and institutional programs of international scope have sent faculty and research personnel on arid lands assignments throughout the arid world. Now the new U.S.AID Natural Resources Program, designed to strengthen further the University's capabilities, will concentrate specifically on three areas:

1. Multiple-use management of natural resources (land, water, wildlife, forest, minerals, energy)
2. Assessment and mitigation of undesirable secondary environmental effects associated with natural resources development projects
3. Application of new technologies to problems of resource surveys, assessment, and monitoring

In support of these three areas of emphasis, five specific programs are being developed:

1. Centralized Information System (CIS): enhancing the University's Arid Lands Information System (ALIS), updating a catalog of natural resources competence, and publication of an international newsletter
2. Education and Training Capability: insuring that the University's graduate degree programs are responsive to appropriate resource management concerns, and that special training opportunities exist for foreign resource specialists

3. Knowledge and Research Capability: increased knowledge resulting from work being conducted both at the University and in some developing countries, contributing to the experience being gained both by the faculty involved and by the developing country
4. Advisory Capability: increasing directly in proportion to its use in research and training as AID, other international assistance agencies, private industry, and developing country institutions call upon the University for its specialized skills and technical knowledge
5. Institutional Linkages: including both informal arrangement for the exchange of information and publications, and major ties between the University and government/educational institutions in developing countries

Dr. Herbert E. Carter, University of Arizona Coordinator of Interdisciplinary Programs, and Chairman of the Natural Resources Program's Policy and Review Board, summed up the meaning of the Program in the first of the seminars which seek to introduce the University Community to an understanding of the Program, when he spoke on September 5, 1974:

"It is hoped that this Grant will provide the impetus for strengthening existing capabilities, initiating essential new activities, and integrating the whole to the end that the University will be recognized internationally as a center of excellence within the United States for information competence and research-and-development capability related to integrated resource management in the developing countries."

## EDITORIAL

Concern over the availability and management of planet Earth's natural resources has become a worldwide theme as we begin the countdown toward the twenty-first century. An increased awareness is evident on all levels — local, national, international — that the world's natural resource base is both finite and limited, and, in the absence of proper stewardship, susceptible to rapid depletion. From this environmental concern has evolved the global attention now being given those areas where narrowly-conceived development projects have wasted and exhausted the resource, preempted better use of the land, and created serious secondary environmental problems, the costs of which may diminish or actually outweigh anticipated benefits over the long term.

This newly-acknowledged perception — that we must not only improve our old ways but also devise new and innovative ways of predicting and managing the resource base to meet long-term goals — comes at the very time when exploding populations are intensifying the immediate demand for more arable land, water, minerals, fuel, and forest products. This poses a cruel dilemma for those developing countries which believe that the development of their indigenous natural resources, given the rapidly accelerating world demand, offers the most expeditious way to disengage their economic well-being from reliance on subsistence agriculture.

Viewed from this global perspective, nowhere is the need and challenge greater than in the semi-arid and arid lands lying within the tropical and sub-tropical zone bounded approximately by the 30° latitude lines. Here are the world's least developed countries, plagued by soaring population rates, vast areas of traditionally dry marginal land, critical new problems of loss of land productivity, soil erosion, and desertification triggered by a combination of natural drought and poor or nonexistent resource management practices. Narrow short-term attempts at immediate solutions through such undertakings as livestock production, water development projects, improved transportation, and certain forestry practices have failed to help these areas sustain even past levels of productivity, let alone keep pace with the inexorable growth of humans and their livestock.

The traditional economic base in these areas has been a subsistence pastoralism, with limited development of irrigated agriculture through oases, intermittent surface runoff, flooding. The choice among alternative uses of limited water resources, particularly in relation to irrigation, is seldom made on a rational basis — one involving a balance

between short-term costs and benefits and long-term economic returns, conservation of water and soils, and proper social and health adjustments. The consequences of this way of life are characterized by destruction of vegetation and soil and the attendant formation of barren desert, exacerbated by inadequate controls over numbers and movements of livestock, a continuing process taking its relentless toll. Collectively the urgency to exploit economically valuable resources for domestic and export purposes, and the absence of capabilities for managing the land and waters, are combining to mortgage severely the future welfare of coming generations in many developing countries.

But to take on only the countenance of Cassandra in the context of today's problems is to court paralysis. The importance and magnitude of those problems are now identified, acknowledged, addressed. Both the new United Nations Environment Programme and UNESCO's Man-and-the-Biosphere Programme have assigned top priority to a consideration of resource management problems of the arid and semi-arid regions. The challenge facing the international development community is to equip the developing nations to bring to resource management a new perspective and capability, one which first establishes the nature and value of the resource base on a broad regional scale, then plans and implements development with an improved appreciation of alternatives and their associated benefit-cost trade-offs, particularly those decisions that could limit or foreclose future operations. Development assistance, therefore, must focus on providing those most-in-need countries with the aid that specifically enables them to assess and manage their own natural resources through training, education, and strengthening institutional competence.

The University of Arizona's Arid/Semi-Arid Natural Resources Program (described elsewhere in this *Newsletter*), undertaken in mid-July 1974 for a period of five years, is one such venture. There are others, and we must believe that among us there will be eventual improvement. Patience, understanding, but also a sense of urgency and drive, will be required. To bring less to the task, or to withdraw from it altogether, will signal to the world that we in the developed world not only have acknowledged our failure to employ our skills in the execution of such enterprises, but have opened ourselves to "thinking the unthinkable."

## SEMINARS

Under the planning and sponsorship of the University of Arizona's U.S. AID 211(d) Natural Resources Program, a series of fifteen seminars was held during the fall of 1974, with an estimated average audience of one hundred interested faculty, students, and townspeople in attendance at each attesting to the varied interest in the topics under discussion. Several of the speakers came fresh from first-hand experience in developing countries, particularly the Sahel-Sudan region, and advantage was taken of the presence of several distinguished foreign visitors on the campus by arranging for their participation in the series.

For the spring of 1975, a new format has been introduced to focus more comprehensively on specific sub-areas of natural resources, of which the first five were an exploration of Human Resources Development, some of them conceptual in nature, others addressing themselves to case studies of specific areas such as Zaire, Ecuador, and Tanzania. Perhaps the underlying question asked in this new series in an effort to stimulate an exchange of ideas and proposals are those which characterized Dean Marsden B. Stokes' talk on January 30, 1975:

"... How many administrators, educators, engineers, scientists, technicians, and other specialists establish rapport with the leaders and the masses in developing nations? What have we learned over the years that will facilitate our working together with these peoples to assist them in improving themselves? What are some of the guidelines for action that should be followed? Are there pitfalls to be avoided?"

He developed the view that the most important resource of any nation is its people, and that emphasis on the development of this resource is the best hope for overcoming problems of poverty, disease, and ignorance.

Dr. Clark Bloom, in his talk in the first series of seminars, urged upon his listeners a recognition of the necessity by developed-country institutions to be both perceptive and willing to learn of ways of achieving what he termed *ex poste* adjustment techniques applied to the building of developing-country organizations and personnel sometimes prior to, at other times concurrent with, the definition and conduct of programs for resource development in these countries — a task that must be done in and by the developing countries themselves.

The seminar on "Drought Analogies," given on October 10, 1974, by Dr. Phil R. Ogden, following his return from Niger, focussed on problems held in common by Niger and the U.S. Southwest Papago Indian Reservation, coterminous to the Tucson area, with similar climates, both inhabited by peoples who view livestock numbers as their wealth and security, and both plagued with drought conditions aggravated by the overgrazing resulting from this philosophy.

These seminars, with their informal conduct, critical questioning — even spirited disagreements — and broad spectrum of interested attendees, have been a successful introduction to the areas of concentration inherent in the Natural Resources Program charter.



Irrigation water is pumped from a well into this reservoir from which it is drawn by gravity toward fenced plots. Near Agades, Niger, September 1974.

—J.D. Johnson

A complete list of seminars given to date follows. Interested readers of this *Newsletter* who would like further information on any of the topics cited are urged to communicate directly with the speakers at the addresses given.

**Outline of AID Natural Resources Grant**

Herbert E. Carter, Coordinator of Interdisciplinary Programs, and Chairman, Natural Resources Program's Policy and Review Board, University of Arizona, Tucson

**An Ecological View of the Sahel—Sudan Region**

E. Lendell Cockrum, Department of Biological Sciences, University of Arizona, Tucson

**Relating Remote Sensor Data to Environmental Modeling**

Waldo Tobler, Department of Geography, University of Michigan, Ann Arbor

**A Framework for Agricultural Development Planning in the Sahel—Sudan Region**

William G. Matlock, Department of Soils, Water, and Engineering, University of Arizona, Tucson

**The Application of U.S. Science and Technology to the Problems of Developing Nations**

Bill L. Long, U.S. Agency for International Development, Washington, D.C.

**Drought Analogies: Niger and the Papago Indian Reservation of Arizona**

Phil R. Ogden, Department of Watershed Management, University of Arizona, Tucson

**Range Improvement in Sonora, Mexico**

Don Johnson, Department of Range Management, University of Sonora, Hermosillo, Sonora, Mexico

**The Drought and Food Shortage Problem in Africa**

Ali El Tom, National Research Council, Khartoum, Sudan

**The Need for Methodology of Mineral Resource Appraisals in Developing Nations**

Allen Clark, Office of Economic Analysis, U.S. Geological Survey, Washington, D.C.

**Utilization of Wildlife Resources in Africa**

James G. Teer, Department of Wildlife and Fisheries Sciences, Texas A&M University, College Station, Texas

**Ten Rules for Coping with Information Systems in Resource Policy Planning**

Aaron Wildavsky, Graduate School of Public Policy, University of California, Berkeley

**Methods and Uses of Mineral Resource Appraisals in Lesser Developed Regions**

DeVerle Harris, Department of Mining and Geological Engineering, University of Arizona, Tucson

**Administering the Planning of Resource Development Programs in Developing Countries**

Clark Bloom, Department of Public Administration, University of Arizona, Tucson

**New Dimensions of Agrarian Reform in Latin America**

Mitchell A. Seligson, Department of Government, University of Arizona, Tucson

**Problems of Future Technical Development and the Oil Producing Countries of the Middle East**

David A. B. Llewelyn, British Petroleum Co., Ltd., London, England

**Human Resource Development in the Less Developed Nations: Some Guides for Action**

Marsden B. Stokes, Department of Educational Foundations and Administration, University of Arizona, Tucson

**Human Resource Development in the Central University of Ecuador: A Case Study**

Freeman J. Wright, California State College, San Bernardino

**A Conceptual Framework for Analysis of Human Resources Development**

Ray Marshall, University of Texas, Austin

**Some Aspects of Manpower Development in Tanzania**

M. I. Karenga, University Dar-es-Salaam/University of Arizona, Tucson

**UNICEF's Sahelian Development Plans**

Ibrahima Fall, Planning Officer, UNICEF/UN, New York

**Administrative Training and Modernization in Zaire**

Gaston V. Rimlinger, Rice University, Houston, Texas

## INFORMATION

The first of the three "outputs" described above, a Centralized Information System (CIS), is being built upon the Arid Lands Information System now widely known by its acronym ALIS, a computerized system developed by the University of Arizona's Office of Arid Lands Studies over a period of years prior to initiation of the Natural Resources Program, originally through National Science Foundation support and now fully operational under University sponsorship. It is a bibliographical storage-and-retrieval system, banking thousands of prime references on the physical and biological environments of world deserts, with retrieval possible through any of the several elements used in formatting references for storage, e.g., author, date, title, source and abstract, but more particularly through the keyword indexing done for each reference from a controlled Thesaurus of Arid Lands Terminology (©), also

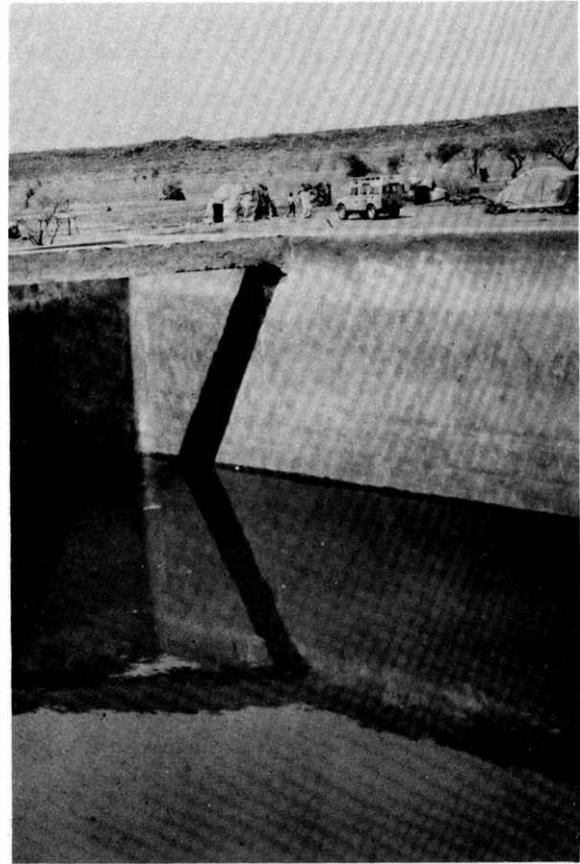
developed by the OALS under an NSF grant, that permits printouts from the system by any mix or match of the indexing terms applied.

Despite its characterization as a world *desert* system, ALIS is enhancing its storage base through the the U.S. AID Natural Resources Program which permits the addition of arid and semi-arid, as well as social, economic, and cultural input not formerly included. While the primary emphasis is still on regional problems of aridity, water, environmental engineering, surface materials, geomorphology, vegetation, and fauna, it is recognized that within the framework of the new Natural Resources Program, the information system must respond increasingly to the need for a wider approach to this particular environment.



Vegetative growth on a sand dune, southern Tunisia, March 1974. The high vertical permeability of sand dunes allows for the collection and storage of enough soil moisture to sustain occasional plant growth.

-J.D. Johnson



Water for this reservoir near Agades, Niger, is supplied from an exploratory borehole and pumped into the reservoir by a centrifugal pump. September 1974.

-J.D. Johnson

ALIS products, in addition to customized printouts (for which a flat charge of \$25.00 is made), include irregular publication of *Arid Lands Abstracts*, a vehicle for disseminating computerized current references plus a special retrospective gathering in each issue on topics such as "Burning as a Tool for Arid Range Management," "Desert Animals," and "Solar Energy." Besides this serial publication, ALIS supports a series of *Arid Lands Resource Information Papers* on contemporary topics of timeliness, carrying extensive computerized bibliographies, with full abstracts, plus interpretative text. While most of these are now out-of-print, reproduced copies are always available for a slight charge from the National Technical Information Service (NTIS), P.O. Box 1553, Springfield, Virginia 22151, USA. Number 5, "Jojoba: A Wax-Producing Shrub of the Sonoran Desert," (1974, 141 p.) is still available from the Office of Arid Lands Studies in limited stock without charge. The preparation of such papers as:

- No. 1: Salinity Problems in Arid Lands Irrigation, 1972, 300 p.
- No. 2: Exploration and Exploitation of Geothermal Resources in Arid and Semiarid Lands, 1973, 118 p. (A revised edition now in preparation)
- No. 3: World Desertification: Cause and Effect, 1973, 168 p.
- No. 4: Southwestern Groundwater Law: A textual and Bibliographic Interpretation, 1974, 228 p.
- No. 5: Impact of Energy Development on Water Resources in Arid Lands, 1975, 268 p.

is indicative of the benefits that may accrue to public agencies – be they governmental, international, institutional – concerned with urgent problems of the environment.

The following examples of reduced, reproduced ALIS/CIS computer output demonstrate the format and configuration of the system:

2987

NATIONAL ACADEMY OF SCIENCES, COMMITTEE ON ATMOSPHERIC SCIENCES

1973

WEATHER AND CLIMATE MODIFICATION, PROBLEMS AND PROGRESS.

SAME AS AUTHOR.

AREAS DELINEATED FOR FURTHER RESEARCH INCLUDE: 1) FOG SUPPRESSION, ESPECIALLY IN RELATION TO AIRPORT OPERATIONS, 2) PRECIPITATION MODIFICATION, DESIGNED PARTICULARLY TO INCREASE PRECIPITATION OVER WATERSHEDS, 3) MITIGATION OF SEVERE STORMS SUCH AS HURRICANES, AND 4) INADVERTENT WEATHER/CLIMATE MODIFICATION EFFECTS.

OALS/WEATHER MODIFICATION/ARTIFICIAL PRECIPITATION/STORMS/FOG/ ENVIRONMENTAL ENGINEERING/WATER YIELD IMPROVEMENT

3060

PUROHIT, F.R./GHOSH, P.K./TANEJA, G.C.

1972

WATER METABOLISM IN DESERT SHEEP. EFFECTS OF VARIOUS DEGREES OF WATER RESTRICTION ON THE DISTRIBUTION OF BODY WATER IN MARIWARI SHEEP.

AUSTRALIAN JOURNAL OF AGRICULTURAL RESEARCH 23(4):685-691. SWRA W73 12788.

THE MOST CRUCIAL LIMITING FACTOR FOR THE SURVIVAL OF LIVESTOCK IN THE ARID AND SEMIARID TRACTS OF WESTERN RAJASTHAN IN NORTHWEST INDIA IS THE CHRONIC SCARCITY OF DRINKING WATER. DURING CRITICAL PERIODS MANY STOCK GROWERS TRY TO SAVE THEIR FLOCKS BY TRANSHUMANCE. BUT MOSTLY THE ANIMALS MUST DEPEND ON THEIR PHYSIOLOGICAL ABILITY TO WITHSTAND WATER DEPRIVATION. EFFECTS OF VARIOUS DEGREES OF WATER RESTRICTION ON THE DISTRIBUTION OF BODY WATER IN MARIWARI SHEEP, ONE OF THE HARDEST BREEDS IN THE RAJASTHAN DESERT, ARE DISCUSSED. THESE SHEEP ARE ABLE TO WITHSTAND A DEHYDRATION LOSS OF ABOUT 18 PERCENT IN BODY WEIGHT. EVIDENCE THAT THEY ARE REASONABLY WELL ADAPTED TO WATER DEPRIVATION. WHEN THE WATER INTAKE WAS REDUCED BELOW 75 PERCENT OF THE NORMAL DAILY REQUIREMENT, THE TOTAL BODY WATER, TOTAL BLOOD AND PLASMA VALUES, AND THE EXTRACELLULAR, INTRACELLULAR, AND INTERSTITIAL FLUID VOLUMES OF THE SHEEP BEGAN TO DECREASE. A REDUCTION TO 25 PERCENT NORMAL INTAKE WAS SIMILAR IN ITS EFFECT TO COMPLETE DEPRIVATION, WITH PLASMA VOLUME FALLING BY 43 PERCENT AND THE EXTRACELLULAR FLUID VOLUME BY 33 PERCENT. HOWEVER, THE ANIMALS DO NOT HAVE THE ABILITY TO MAINTAIN AN EXPANDED PLASMA VOLUME AGAINST GENERAL DEHYDRATION. (OALS)

SURVIVAL/OALS/ANIMAL METABOLISM/WATER REQUIREMENTS/ANIMAL PHYSIOLOGY/DROUGHT TOLERANCE/ARID LANDS/DESERTS/LIVESTOCK/WATER SHORTAGE/WATER UTILIZATION/ADAPTATION/BODY FLUIDS/SHEEP(DOMESTIC)/STRESS(PHYSIOLOGY)/INDIA/RAJASTHAN

3829

MACLEOD, N.H.

1973

APPLICATIONS OF REMOTE SENSING (ERTS) TO RESOURCE MANAGEMENT AND DEVELOPMENT IN SAHELIAN AFRICA (REPUBLIC OF MALI). IN: SYMPOSIUM ON SIGNIFICANT RESULTS OBTAINED FROM THE EARTH RESOURCES TECHNOLOGY SATELLITE-1. I: TECHNICAL PRESENTATIONS, SECT 8, P. 1475-1481.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION REPORT NASA SP-327. SWRA W74-06686.

THE PRIMARY RESOURCE MANAGEMENT PROBLEM IN SUB-SAHARAN AFRICA (THE SAHEL) IS INCREASING ARIDITY. ERTS OBSERVATIONS WERE MADE OF SAND STREAMS, DUNE ORIENTATIONS, MOISTURE AND VEGETATION CHANGES AND OTHER FACTORS. A SECOND MAJOR INTEREST IS GRAZING OF CATTLE, SHEEP, AND GOATS, WHICH IS ASSOCIATED WITH MAJOR MOVEMENTS OF PEOPLE AND ANIMALS TWICE YEARLY TO OBTAIN FORAGE. THE CHANGES IN AVAILABLE FORAGE ARE BEING OBSERVED. THE LOCATION OF THE CULTIVATORS IS ALSO BEING MAPPED FROM ERTS IMAGERY. HYDROLOGICAL ANALYSIS IS BEING CARRIED ON IN THE NIGER AND BANI RIVER WATERSHEDS. THE SIZE, TIMING, AND AREAL EXTENT OF THE ANNUAL FLOOD IS OF PARTICULAR INTEREST. SO FAR, GOOD IMAGERY OF THE MAXIMUM FLOOD STAGE HAS BEEN OBTAINED AND ASSESSED. GEOLOGIC INFORMATION ON FAULT ZONES, SAND DUNE FORMATIONS, SCARPS, TECTONIC BASINS AND FOCAL POINTS OF FAULTING ARE ALL VISIBLE. (USGS)

OALS/REMOTE SENSING/SATELLITES(ARTIFICIAL)/LAND USE/GEOLOGIC MAPPING/GRAZING/FLOODS/DESERTS/DATA COLLECTIONS/DUNES/ARID LANDS/SAHELIAN ZONE /SAHARA/MALI/RESOURCE INVENTORY

## LINKAGES

Creation of a series of linkages between the University of Arizona and other institutions with a commitment to natural resources is perceived to be a key output of the 211(d) Natural Resources Program here, since it affords a practical mechanism for sustaining interest in and use of the other outputs of the grant. In addition, it provides a vehicle for concentrating program resources on selected problems of import with enough critical mass to have a positive impact. Beyond, such linkages can lead to relationships that will facilitate developing country resource management objectives long after termination of the U.S. Aid grant. From an assessment of the potential for specific early linkages in terms of a country's existing institutional capability and the nature of its problems, two such linkages have been established:

1. **KENYA.** A country of roughly 225,000 square miles, Kenya lies astride the equator in eastern Africa between the Indian Ocean and Lake Victoria. The northern three-fifths of the country, and large stretches of the southern section are suitable only for ranching or nomadic herding, or provide only a meager and uncertain livelihood for cultivators. In effect, less than half the country's area is arable, with over 100,000 square miles actually desert or semi-desert. This Northern Zone, extending latitudinally across the three southern zones and generally forming their northern limits, is a barren waterless steppe underlain by volcanic rock, a region of poor soil, hot dry climate, and sparse population. Most of the country north of the equator has little rainfall, and is hot and arid. Even elsewhere, however, the unreliability of rainfall has contributed to the harsh conditions faced by the people residing outside the most favored areas. Drought has periodically resulted in complete crop or pasture failure and attendant famine. Rainfall probability is extremely low for most of the country, despite the pleasant climate prevailing in the areas of highest population concentration. An irregular network of intermittent streams and minor rivers plays a role in the drainage of the Highland slopes and in maintaining the fertility of its productive areas. It is also a potential source of irrigation for the development of additional agricultural acreage.

The University of Nairobi is the main institution of higher learning, with departments in applied plant sciences, crop production, land development, meteorology, soil science, surveying and photogrammetry, and veterinary science, plus associated library and laboratory support.

Development plans emphasize agriculture, land use/land tenure, animal husbandry, and agricultural credit and cooperatives. With government agencies such as the Ministry of Finance determined to improve the lot of Kenya's people through increasing and diversifying the scope of agricultural production, particularly in marginal lands to the north, the advantages of a linkage to both parties is plain, whereby an entire spectrum of problems

can be visualized and dealt with. Because opportunities for exchange of information and personnel are several, an Arizona team is now in Kenya for preliminary discussions toward this end, so that the first of our two initial linkages may be consummated.

2. **GHANA.** One of the southern tier of countries facing on the Gulf of Guinea in the great bulge of West Africa, Ghana's 92,100 square miles lie entirely in the tropics. Of particular interest to Arizona is the northern portion, characterized by high plains, decreasing rainfall, poor soil conditions, and a long hot dry season. The entire country is interlaced by a net of streams and rivers, mostly part of the vast Volta drainage system which covers some 61,000 square miles, or more than two-thirds of the country. Lake Volta, created by the closing of a dam across the Volta at Akosombo in 1964, has backed up along the entire former course of the River, with arms extending into many tributaries.

Institutions of higher learning include the University of Ghana, Legon; the University of Science and Technology, Kumasi; and the University College of Cape Coast, Cape Coast, devoted in the main to teacher training. Most of the country's practical research is carried out under the national Council for Scientific and Industrial Research (CSIR), a statutory corporation subsidized through the Ministry of Finance and Economic Planning. Encouragement of scientific and industrial research significant to the country's development, and control over the research activities of a number of attached research institutes and units are carried out under the aegis of this Council. Some of these agencies are addressing themselves to research on animals and aquatic biology, on crops, soil, forest products, buildings and roads; of foods, standards, and industrial research; and on water and agricultural undertakings.

Arizona's Natural Resources Program Director, Dr. J.D. Johnson, in a report to the USAID Mission to Ghana (1974), entitled "Drought in the Ghana Savannah," summarized his recommendations, following his visit there in the early spring of 1974, by pointing out that a strengthened CSIR, through the existing Natural Resources Committee bolstered by adequate staff, discretionary research funds, and technical assistance from donor organizations, would help Ghana avert the tragic effects of the Sahelian desertification process and in so doing be in a position to establish world leadership in wise land use planning. The designation of Ghana as one of the first two linkages to be constituted through the University of Arizona's Natural Resources Program is a step in this direction. Achievement of better research integration, an effective extension service, a determination of the true carrying capacity of the land, application of remote sensing methods to accelerate natural resources inventories, and studies on water harvesting techniques are examples of potential investigations having a bearing on this long-term goal.

## VISITORS

AFGHAN, Dr. A.Q.K.  
Ministry of Science and Technology  
Islamabad, Pakistan  
August 1974

BOKHARI, Manzoor  
Joint Secretary, Economic Affairs  
Division  
Government of Pakistan  
[currently] FOA Andre-Mayer Fellow  
University of Arizona  
August 1974 - to date

CARPENTER, Dr. Neil  
Chief of Farm Management  
Agricultural Services Division  
FOA, Rome  
December 1974

DODOO, Dr. Robert  
Secretary, Natural Resources  
Committee  
Council for Scientific and  
Industrial Research  
Accra, Ghana  
July 1974

FALL, Ibrahima  
UNICEF/UN  
New York  
March 1975

HAMDAN, Dr. Ibrahim Y.  
Project Leader,  
Agriculture Division  
Kuwait Institute for Scientific  
Research  
Kuwait  
October 1974

HARDAN, Dr. Adnan  
Deputy Secretary  
Ministry of Agriculture  
Baghdad, Iraq  
November 1974

HASHMI, Dr. Z.A.  
Chairman, Pakistan Science  
Foundation  
Islamabad, Pakistan  
August 1974

HOARE, Mr. Eric  
Chief, CSIRO Division of  
Irrigation Research  
Griffith, New South Wales, Australia  
July 1974

HUGO, Dr. W.J.  
South African Embassy  
Washington, D.C.  
September 1974

JOUBERT, Dr. Eugene  
Senior Research Officer  
(Ecology)  
Nature Conservation & Tourism  
Division  
Windhoek, South West Africa  
January 1975

KARENKA, M.I.  
University of Dar-es-Salaam  
Tanzania  
February 1974

KETTANEH, Dr. M. Said  
Secretary General, Scientific  
Research Foundation  
Jadiriya  
Baghdad, Iraq  
October 1974

KHETRAN, M. Anwar  
Registrar, University of Baluchistan  
Quetta, Pakistan  
September 1974

LLEWELYN, David A.B.  
British Petroleum Company, Ltd.  
London  
December 1974

LOPEZ, Ing. Benito Canales  
Subdirector Industrial  
Comisión Nacional de las  
Zonas Áridas  
Mexico, D.F.  
October 1974

MARENAH, Dr. Lamin J.  
Ministry of Agricultura and  
Natural Resources  
Gambia  
August 1974

MORALES, Joaquín  
Vice-Rector, Universidad del  
Norte  
Antofagasta, Chile  
October 1974

EL-NADI, Dr. Abdel Mohsin H  
School of Agriculture  
University of Khartoum  
Khartoum, Sudan  
July 1974

PENÁ, Dr. Carlos E.  
Director de Coordinación  
Consejo Nacional de Ciencia y  
Tecnología  
Mexico, D.F.  
October 1974

PUEBLA, Ing. Manuel  
Consejo Nacional de Ciencia  
y Tecnología  
Mexico, D.F.  
October 1974

QUARTEY-PAPAFIO  
Deputy Director (Operations)  
Ministry of Agriculture  
Accra, Ghana  
July 1974

QUINTANA, Harnán Danyau  
Rector, Universidad del Norte  
Antofagasta, Chile  
October 1974

RICHMOND, Dr. Amos  
Director, Desert Research Institute  
Ben-Gurion University of the Negev  
Sde Boker, Israel  
June 1974

SAILE, Mr. David  
School of Architecture  
University of Newcastle-on-Tyne  
England  
December 1974

SPOONER, Dr. Brian  
Department of Anthropology  
University of Pennsylvania  
c/o Division of Human Environment  
Department of Environmental  
Conservation  
Tehran, Iran  
December 1974

EL-TOM, Ali  
National Research Council  
Khartoum, Sudan  
October 1974

UNDERHILL, H.W.  
Land and Water Development Division  
FAO, Rome  
May 1974

WAHID, Dr. Abdul  
University of Karachi  
Karachi, Pakistan  
August 1974

WOLF, Professor David  
Weizmann Institute  
Rehovot, Israel  
August 1974

**UNUSUAL PUBLICATIONS OF INTEREST TO THE  
NATURAL RESOURCES PROGRAM**

Meinel, A.B./Meinel, M.P.  
1973

**THE VILLAGE ENERGY CENTER: A NEW OPTION FOR SOLAR ENERGY UTILIZATION BY SAHEL COMMUNITIES.** A report prepared for UNESCO, Paris, July 1973. University of Arizona, Optical Sciences Center/Helio Associates, Inc., Tucson.

A review of the successes and failures of present attempts to utilize solar energy in developing countries leads the authors to consider a new proposal: the village energy center (VEC). It builds on the successes of community uses and recognizes the failures in individual family uses of solar energy. The VEC distributes electrical power from a solar thermal powerplant to meet the wide variety of needs for energy within the community, and to power the tube wells of its surrounding fields. Early development of the energy center can profit from current interest in solar energy in the U.S. because of similarity in size of early demonstration units to actual units for energy centers for developing countries. Aspects of the VEC and its application to the Sahel are specifically discussed. (OALS)

Curtis, Lawrence C./Gomez, C., Héctor  
1974

**CUCURBITA FOETIDISSIMA, UNA FUENTE POTENCIAL DE ACEITE Y PROTEINA EN ZONAS ARIDAS.** Centro Nacional de Investigación para el Desarrollo de Zonas Aridas, Saltillo, Coahuila, México. Boletín Técnico 4. 12(1) p.

In conjunction with the Ford Foundation's investigations in Lebanon relating to this plant, the CSNIZA has issued this bulletin relating its experience in Mexico with greenhouse cultivation of hybrid seed developed in Lebanon. Emphasis was on evaluation of the combined aptitude of buffalogourd for production of oil and protein for commercial use. Preliminary findings from research done there indicate the possibility of as much as 34% oil and an equal percentage of protein. The protein content is sufficient to warrant further research into its digestibility by humans as well as livestock. Its cultivation in arid zones is feasible, thereby achieving not only use of otherwise unproductive areas, but contributing to a solution to shortages. (OALS)

One of the most useful series of publications available are the

**AREA HANDBOOKS**

prepared by Foreign Area Studies of the American University (5010 Wisconsin Avenue, N.W., Washington, D.C. 20016) and available for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 at varying prices. Those covering countries whose areas include significant arid and semi-arid zones include Afghanistan, Algeria, Angola, Argentina, Chad, Chile, Egypt, Ethiopia, Ghana, India, Iran, Iraq, Israel, Jordan, Kenya, Lebanon, Libya, Mauritania, Mexico, Mongolia, Morocco, Nigeria, Pakistan, Peru, Saudi Arabia, Senegal, Somalia, Sudan, Syria, and Tunisia. While Handbooks are designed to be useful to military and other personnel who need a convenient compilation of basic facts about the social, economic, political and military institutions and practices of various countries, the emphasis is on objective descriptions of the nation's present societies and the kinds of possible or probable changes that might be expected in the future. Extensive bibliographies provide recourse to other published sources for more detailed information. Revised editions are issued as needed. Capsule information on topography, climate, population, languages, religions, education, health, government, justice, economy, exports-imports, communications, armed forces, transportation, and international memberships and agreements adds to their value.

Saad, K.  
1970-1971

**MALI. ETUDE HYDROGEOLOGIQUE DU NORD DE LA BOUCLE DU NIGER: ETUDE HYDROGEOLOGIQUE DU SUD DU MALI (NIGER SUPERIEUR ET BANI). HYDROGEOLOGIE.** Document #2257-2259/RMS.RS/SCE. **ETUDE HYDROGEOLOGIQUE DE L'EST DU MALI.** Document #1856/BMS.RD/SCF. **HYDROLOGIE: NOTE SUR LA PROPAGATION DE LA CRUE DU NIGER ET DU BANI EN AVAIL DE KOULIKORO ET DE DOUNA.** Document #2192, 2202/BMS.RD/SCE. Unesco, Paris.

Davy, E.G.  
1974

**A SURVEY OF METEOROLOGICAL AND HYDROLOGICAL DATA AVAILABLE IN SIX SAHELIAN COUNTRIES OF WEST AFRICA. A SURVEY OF STUDIES IN METEOROLOGY AND HYDROLOGY IN THE SUDANO-SAHELIAN ZONE OF WEST AFRICA.** World Meteorological Organization, Geneva, WMO/OMM 379. 119 p.

The first survey assembles information on basic data useful in projects for the development of the economy of the Sahelian zone generally, and with particular reference to the catastrophic drought covering five years through the survey year of 1973. The second covers background information for a program of development of applications of meteorology in the Sahelian zone, with special reference to the mitigation of the effects of drought. Proposals and projects in meteorology and hydrology pertaining to the Sahel include topics on agrometeorology, flood forecasting, weather modification, drought, desert encroachment, climatic fluctuations, and ecology. (OALS)

**A.I.D. MEMORY DOCUMENTS, RESEARCH 1962-1972, Vol. B, May 1974** contains citations to approximately 900 documents produced with A.I.D. financing over this period of time, to increase awareness of these documentary resources and indicate machinery for acquiring copies. Full bibliographical citations are grouped by subject classification, and access is through additional indexes of subject/geographic listings, personal authors, and project/contract numbers. A random selection of topics shows extensive documentation under such items as social conditions and change; labor, manpower, unemployment; natural resources; medical sciences and public health; field crops; livestock and domestic animals. Geographic coverage shows entries under Africa and Latin America, with sub-headings under specific countries, as well as other areas worldwide. This is a typical NTIS-format publication, available from A.I.D. Reference Center, Agency for International Development, Washington, D.C. 20523, as document ARC No. 017.1-A265b. (OALS)

As a follow-on, current research documents since 1972 are listed and abstracted in a quarterly publication, **A.I.D. RESEARCH AND DEVELOPMENT ABSTRACTS**, available from A.I.D. Technical Assistance Bureau, RA/RIG, Washington, 20523. Arranged under broad headings such as Agriculture (with sub-headings under such terms as cereal crops, farm mechanization, irrigation, soils and fertilizers, Economics (agricultural credit, agricultural marketing), Education, Public Health (nutrition), Science and Technology, Social Science (land tenure), this tool carries informative abstracts, together with full bibliographical information. Instructions are given for ordering copies of documents cited. (OALS)

Food and Agriculture Organization of the United Nations,  
Rome  
1974

**HEATHLAND AND SAND DUNE AFFORESTATION: REPORT ON THE FOA/DANIDA INTERNATIONAL TRAINING CENTRE, DENMARK AND LIBYA, AUGUST 26-SEPTEMBER 21, 1973.** FAO/DEN/TF 123. 239 p.

Information presented is the result of a training center held in Denmark and Libya to provide opportunity for exchange of information on sand dune stabilization, afforestation, and shelterbelt management. Field trips in both countries allowed evaluation of practices of traditional biological-mechanical fixation, as well as crude oil and rubber coating techniques of stabilization. Nursery management and forest management of greenbelts and shelterbelts were viewed near Tripoli. Country statements from the arid zones include India, Iraq, Jordan, Libya, Somalia, Sudan, Syria, Tunisia, and Yemen. (OALS)

National Academy of Sciences  
1974

**MORE WATER FOR ARID LANDS.** Promising Technologies and Research Opportunities Report of an Ad Hoc Panel of the Advisory Committee on Technology Innovation, Board on Science and Technology for International Development, Commission on International Relations. Résumé en Français, Resumen en Español. National Academy of Sciences, Washington, D.C. 153 p.

Little known but promising technologies for the use and conservation of scarce water supplies in arid areas are covered in this non-technical handbook that aims to draw the attention of agricultural and community officials and researchers to opportunities for development projects with probable high social value. The technologies discussed should, at present, be seen as supplements to, not substitutes for, standard large-scale water supply and management methods. But many have immediate local value for small-scale water development and conservation, especially in remote areas with intermittent rainfall. Each technology presented is covered by such topics as methods, advantages, limitations, stage of development, and needed research and development. Selection of technologies examined was based on technical merit and potential for application, particularly in developing countries. Under Water Supply there is discussion of rainwater harvesting, runoff agriculture, irrigation with saline water, reuse of water, wells, and other sources of water. Under Water Conservation the discussion centers on reducing evaporation from water surfaces, reducing seepage losses, reducing evaporation from soil surfaces, trickle irrigation, selecting and managing crops to use water more efficiently, controlled-environment agriculture, reducing cropland percolation losses, and reducing transpiration.

Benneh, G  
1974

**ENVIRONMENT AND AGRICULTURAL DEVELOPMENT IN THE SAVANNAH REGIONS OF GHANA. ANNOTATED BIBLIOGRAPHY**, Ghana Council for Scientific and Industrial Research, Natural Resources Committee/U.S. Agency for International Development. 188 p. Mimeo.

Over 500 items are grouped in broad categories: agricultural development, including such factors as soils, vegetation, land tenure, climate and water resources; land use, including farming systems, livestock, and crops; fires, pests and diseases, and droughts; and strategies for development, such as resettlement, extension services, and mechanization. The bibliography fills a need for an integrated approach to solving the urgent problems of the savanna environment by providing a comprehensive compilation of references, with their locations in Ghana, describing research already undertaken on the above topics.

**WAR ON HUNGER.** A report from the Agency for International Development. Publications Division, Office of Public Affairs, AID. Room 4953, State Department Building, Washington, D.C. 20523, v. 9, No. 1, January 1975—

A monthly publication devoted to worldwide activities engaged in the greatest war of all, with the emphasis on features of general interest, reviews, articles by world experts on such topics as world fertility patterns, drought, livestock management, managing development with trained talent, the fertilizer "panic," AID's role in remote sensing, and helping the artisan fisherman, to cite those in some recent issues. It is available without cost to persons requesting to be placed on the mailing list, and readers are invited to submit news items, original manuscripts, and photos on any aspect of International development.



Water harvesting in Southern Tunisia. Runoff which normally evaporates unused is stored to fill the needs of people and animals. March 1974.

—J.D. Johnson

**WORKSHOP-SEMINAR ON SPACE APPLICATIONS OF  
DIRECT INTEREST TO DEVELOPING COUNTRIES.**

Organized by the Committee on Space Research (COSPAR), through its Working Group 6 on Applications of Space Research to Meteorology and Earth Surveys/Brazilian Space Research Institute (INPE). Sponsored by the United Nations Environment Program, International Council of Scientific Unions, Comité Interamericano de Investigaciones Espaciales, Committee on Science and Technology in Developing Countries, and the INPE. 1974. São José dos Campos, Brasil. 2 vols.

The purpose of this workshop-seminar was to transfer technical information to participants from developing countries in Asia, Africa, and Latin America, on the techniques for the use of data acquired in surveying the earth from space, to apply these techniques to specific problems of developing countries; to show their high effectiveness as a basis for social-economic development and motivate the participants to adopt programs in their countries of origin to take advantage of the outputs generated by systems like ERTS, at a low cost; and to point out the great benefits to be derived for the development of many areas of economic interest such as may be found in improving range, crop and forest land management, mineral exploration, and the use of water resources.

Sometimes we see forward more clearly for a backward glance:

... Two systems of ancient agriculture in the Negev—narrow terraced wadis and farm units with small watersheds—show a most rational and wise use of the available natural resources. The ancient farmer fitted his artificially-created agricultural ecosystems into nature and used landscape and topography to his best advantage without damaging his environment. He neither caused erosion nor brought about salination of his agricultural soils. By using the runoff he tamed the flood torrents and prevented the damage that uncontrolled floods usually produce. He certainly did not over irrigate, because his water resources were limited, and in this case as in many others, limitation is the mother of good management. The methods of the ancient civilizations of providing drinking water are another example of a most rational use of nature's resources. In all these cases man learned from his natural environment and applied what he had observed by imitating nature and sometimes improving on it.

—THE NEGEV: THE CHALLENGE OF A DESERT,  
by Michael Evenari, Leslie Shanan, and  
Naphtali Tadmor

**ARID/SEMI-ARID NATURAL RESOURCES PROGRAM**

**NEWSLETTER**

No. 1, March 1975

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Editor: Patricia Paylore, Assistant Director (International), Office of Arid Lands Studies, University of Arizona, Tucson, Arizona 85721, USA.

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